

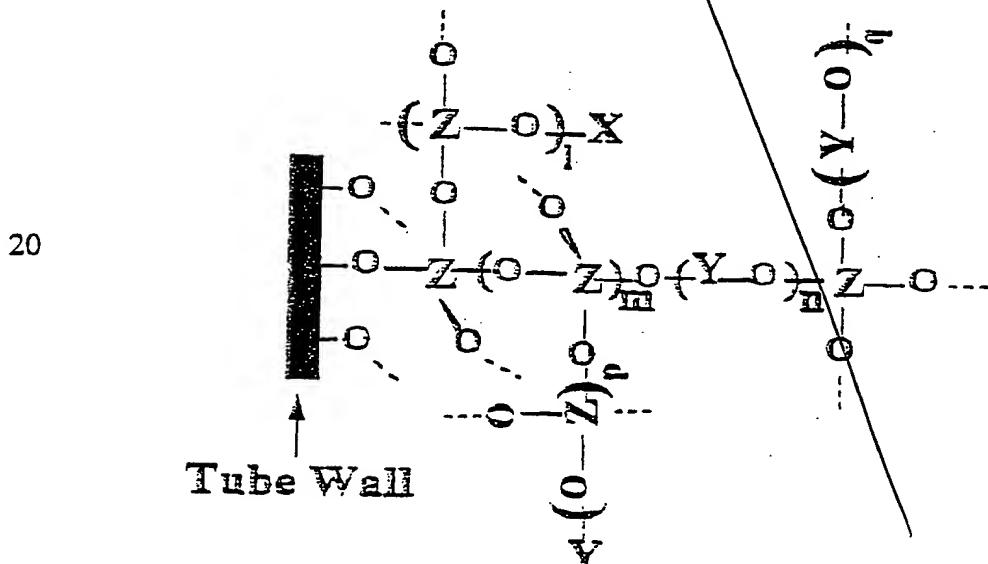
CLAIMS

What is claimed is:

5        1. A capillary column comprising:  
a. a tube structure, and  
b. a deactivated surface-bonded sol-gel coating on a portion  
of the tube structure to form a stationary phase coating on that portion of  
the tube structure,

10        said deactivated stationary-phase sol-gel coating enabling  
separation of analytes while minimizing adsorption of analytes on the sol-  
gel coated tube structure.

2. A capillary column as set forth in claim 1, wherein said  
15 deactivated surface-bonded sol-gel-coating on the portion of the tube  
structure has the formula:



wherein,

X = Residual of a deactivation reagent;

Y = Sol-gel reaction residual of a sol-gel-active organic molecule;

Z = Sol-gel precursor-forming element;

5 l = An integer  $\geq 0$ ;

m = An integer  $\geq 0$ ;

n = An integer  $\geq 0$ ;

p = An integer  $\geq 0$ ;

q = An integer  $\geq 0$ ;

10 and

l, m, n, p, and q are not simultaneously zero.

Dotted lines indicate the continuation of the chemical structure  
with X, Y, Z, or Hydrogen (H) in space.

15 3. A capillary column as in claim 2 wherein the residual of  
the deactivation reagent is selected from the group including  
polymethylhydrosiloxane and hexamethyldisilazane.

20 4. A capillary column as in claim 2 wherein said sol-gel  
reaction residual is selected from the group including molecules with  
hydroxysilane or alkoxy silane functional groups or a combination thereof,  
either polymers or monomers, such as polydimethylsiloxane (PDMS),

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polymethylphenylsiloxane (PMPS), polydimethyldiphenylsiloxane (PDMDPS), polyethylene glycol (PEG) and related polymers like Carbowax 20M, polyalkylene glycol such as Ucon, macrocyclic molecules like cyclodextrins, crown ethers, calixarenes, alkyl moieties 5 like octadecyl, and octyl.

5. A capillary column as in claim 2 wherein said sol-gel precursor forming element is selected from the group including Si, Al, Ti, and Zr.

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6. A method of preparing a capillary column comprising the steps of:

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- a. providing as tube structure;
- b. providing a sol-gel solution comprising:

functional group,

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- i. a sol-gel precursor,
- ii. an organic material with at least one sol-gel active
- iii. a sol-gel catalyst,
- iv. a deactivation reagent, and
- v. a solvent system;

*Susp 1*

- c. reacting at least a portion of the tube structure with the sol-gel solution under controlled conditions to produce a surface-bonded sol-gel coating on the portion of the tube structure;
- d. expelling the sol-gel solution from the portion of the tube structure; and
- 5 e. heating the coated portion of the tube structure under controlled conditions to cause the deactivation reagent to react with the surface-bonded sol-gel coating to deactivate and to condition the sol-gel coated portion of the tube structure.

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*Susp 2*

7. A method as set forth in claim 6, including the step of hydrothermally pretreating the tube structure before reacting the portion of the tube structure with the sol-gel solution.

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*Susp 3*

8. A method as set forth in claim 7, wherein the step of providing the tube structure comprises providing a tube structure with an inner wall, reacting the sol-gel solution with the inner wall of the tube structure for a period less than 1 hour to form a surface-bonded sol-gel coating on the inner wall of the tube structure, and then applying gas pressure to the sol-gel solution in the tube structure to expel the sol-gel solution from the tube structure.

9. A method as set forth in claim 8, wherein the sol-gel precursor comprises an alkoxy compound, the organic material comprises monomeric or polymeric material with at least one sol-gel active functional group, the sol-gel catalyst is taken from a group consisting of 5 an acid, a base and a fluoride compound, and the deactivation reagent comprises a material reactive to hydroxyl groups bonded to the sol-gel precursor forming element or to the tube wall surface.

10. A method of preparing a capillary column by 10 simultaneously deactivating, coating and immobilizing a stationary phase on a tube structure.

11. A method as set forth in claim 10 further defined as 15 chemically bonding stationary phase molecules to an interfacial organic-inorganic polymer layer, the polymer layer evolving over a surface of the tube structure.